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(54) Improvements in or relating to liquid dispensers.

(57) A liquid dispenser comprises a cylinder (20), a piston (22) slidable on the cylinder (20), a coarse selection ring (41) for coarse selection of the amount of liquid to be dispensed and a fine selection ring (64) for fine adjustment. The selected amount of liquid to be dispensed is displayed on a digital display (16). Rotation of the coarse selection ring (41) rotates a stop supporting member (36) so as to select one of a plurality of pairs of stops (40) of differing axial length, whilst rotation of the fine adjustment ring (64) moves the stop supporting member (36) in an axial direction.

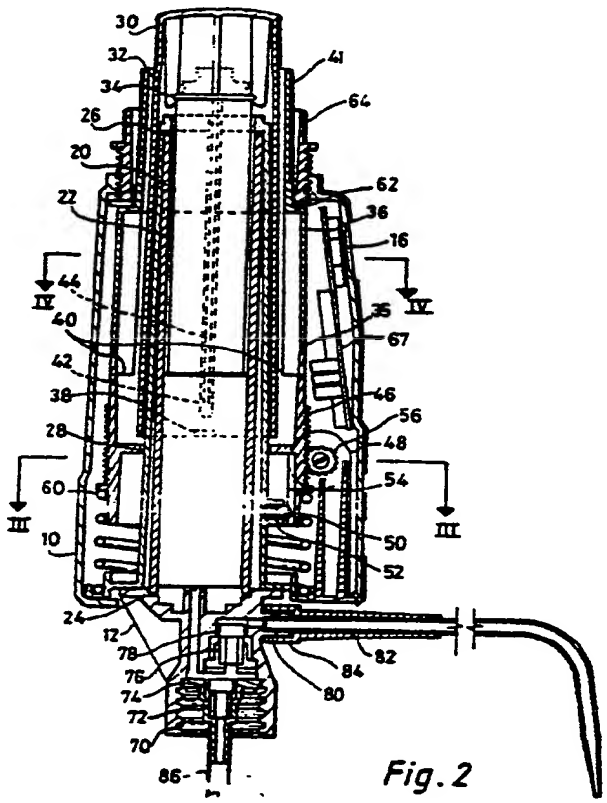

Fig. 2

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Improvements in or relating to Liquid Dispensers

Field of th invention

This invention relates to a liquid dispenser.

Background to the invention

There is a requirement in industry and more especially in chemical laboratories to be able to dispense selected amounts of chemical reagents and the like from a storage jar or similar reservoir, in the manner of a pipette.

Liquid dispensing units for this purpose are known, and in general comprise a cylinder and piston unit operable with an adjustable stroke to draw in a selected amount of liquid from the reservoir and discharge this selected amount of liquid through a discharge tube.

It is an object of this invention to provide improvements in the means by which the amount of liquid to be dispensed is controlled and indicated.

The invention

According to the invention, a liquid dispenser comprises a unit having means enabling its connection to a reservoir containing a liquid to be dispensed and a discharge tube through which a selected amount of said liquid can be dispensed, the unit including a cylinder and piston combination enabling the selected amount of liquid to be drawn into the cylinder from the reservoir through a check valve means and the said selected amount of liquid to be dispensed through the discharge tube via a second check valve means, wherein a selector means for adjustable stops for setting the cylinder/piston stroke to select the amount of liquid to be dispensed is coupled to an electromechanical transducer which provides an electrical signal for controlling operation of a display means which indicates the amount of liquid selected.

A preferred display means is a digital display device incorporated in the unit and eletrically driven by a drive signal obtained by processing the output signal of the transducer, which latter preferably comprises a potentiometer.

In a preferred arrangement, the selector means includes a stop supporting member which is rotatable for setting the cylinder/piston stroke. Said member may conveniently carry a helical gear which drives a pinion coupled to the transducer.

The said stop supporting member is preferably rotatable in angular steps, defined by detent means, to select any one of a plurality of stops of differing axial length which limit the cylinder/piston stroke. Such rotation of the stop supporting member thus provides for coarse selection of the amount of liquid to be dispensed. For fine adjustment purposes, the stop supporting member is preferably also adjustable in the axial direction, carrying the axially extending stops with it. The helical gear then acts as a rack to drive the pinion. Axial movement of the stop supporting member may be enabled by a tapered thrust washer.

The detent means which defines the angular position of the stop supporting member may conveniently take the form of a spring loaded ball detent cooperating with angularly spaced slots in the stop supporting member. This detent means, preferably in conjunction with the above-mentioned tapered thrust washer, is then able to act to preload the gear/pinion coupling in order to minimise backlash.

For minimising tilting or rocking forces, each axially extending stop is preferably formed in two diametrically opposed similar parts. Moreover, the range of rotational adjustment of the stop supporting member, and thus of the gear coupling which drives the transducer, may be increased by arranging the stops of progressively increasing axial length in two or more interleaved groups.

The said angularly extending stops, each comprising two diametrically opposed similar parts, preferably cooperate with a pair of stop elements carried by a piston drive member which is exposed for manual operation. Said stop elements are preferably also a diametrically opposed pair, conveniently on a diameter at right angles to the diameter on which the gear coupling is located, so that wear in the gears does not affect the accuracy of selection of the amount of liquid to be dispensed.

Description of drawings

A liquid dispensing unit in accordance with the invention is exemplified in the following description, making reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of the unit;

Figure 2 is a vertical axial cross-sectional view through the unit;

Figure 3 is a transverse cross section on the lin III-III of Figur 2;

Figure 4 is a scrap view, taken on the cross section indicated by the line IV-IV in Figure 2; and

Figure 5 is a developed view showning a series of stops "unfolded".

Description of embodiment

The unit illustrated in Figure 1 comprises a casing 10 of plastics material having an attached base fitting 12 which enables the unit to be screw connected to the threaded neck of a storage jar constituting a reservoir for a liquid chemical to be dispensed. Reference 14 denotes a discharge tube through which a selected amount of said liquid is discharged when the unit is used. A digital display 16 is operable to indicate the amount of liquid selected for dispensing, whilst on/off switch 18 switches the display device, and its associated electronics, powered from an on-board battery source, on and off. The construction and manner of operation of the unit will now be described with reference to Figure 2 to 5.

Within the casing 10 is a cylinder 20 surrounding a piston 22, both cylinder and piston being made of boro-silicate glass. The cylinder 20 is sealed at the bottom via 'O' ring 24 to the base fitting 12 and at the top resiliently seals by means of 'O' ring 26 to moulded inner sleeve member 28, which at the bottom is assembled by means of screws to the base fitting 12, thus clamping the cylinder in position.

The base fitting 12 accommodates moulded fittings in the form of a mounting screw 70 enabling fitting of the unit to a bottle neck, check valve housing for boro-silicate glass check valves referenced 72, 74, 76, 78 and the mounting 80 for the dispensing spout 14, which comprises discharge tube 82 retained by retaining sleeve 84. Reference 86 denotes a suction tube via which liquid is drawn into the cylinder 20 through check valve 72, 74. Dispensing through the discharge tube 14 is via check valve 76, 78.

The piston is axially displaced in the cylinder 20 by means of moulded cap member 30, which has lugs 32 by which it clips to rim 34 of the piston 22. The cap member 30 has a main wall principally accommodated between the inner sleeve member 28 and a moulded outer sleeve member 36, and the cap member 30 has two external stops 38 which bear against internal fins 40 provided around an adjustable ring 41 constituted by the upper end of the outer sleeve member 36. The fins 40 increment in length from a minimum to a maximum to define the dispensing range of the unit and to enable coarse adjustment within this range by stepped variation of the stroke of the piston.

The outer sleeve member 36 is in practice formed by coaxial upper and lower mouldings which cooperate at stepped split line 35, torsional drive betw en the mouldings being enabled by the extension of three pairs of stop fins 40 downwardly from the upper moulding into slots in the lower moulding.

The inner sleeve member 28 is formed with two external grooves 42 which engage with internal flutes 44 on the cap member 30 to prevent relative rotation therebetween. The inner sleeve member 28 also provides a circular rotation register and stops for the outer sleeve member 36, mounting lugs for a potentiometer 48 and a housing for a boro-silicate glass ball 50 and an associated stainless steel spring 52.

The outer sleeve member 36 has internal slots 54 serving as indexing detents for the spring loaded ball 50, thus ensuring that the stops 38 are aligned with a pair of fins 40 each time the outer sleeve member 36 is rotated. Gearing is provided on the member 36 in the form of a helical gear 46 which engages with helical pinion 56. Full travel stops 58 on the outer sleeve member 36 come to bear against the ball housing at the angular limits of rotation.

The adjustment ring 41 at the upper end of the outer sleeve member 36 enables indexed relative rotation, through an angle up to 315 degrees, to enable any one of twelve differing length fins 40 on the interior of the ring to be aligned with the stops 38 on the cap member 30, thereby coarsely to select the piston stroke.

Coil spring 60 bears against a flange adjacent the lower end of the outer sleeve member 36 to thrust the moulding upwards into firm contact with a tapered thrust washer 62. Reference 64 denotes an externally threaded ring member which engages in the casing 10. The upper part of this member 64 constitutes a fine adjustment ring. As the ring member 64 is screwed downwardly it forces thrust washer 62 and coarse adjustment ring 41 downwardly, thus effectively providing fine adjustment of the stop length and thereby of the piston stroke.

The pinion 56 is rotated in proportion to the volume set to be dispensed by the dual action of the helical gear 46 on the outer sleeve member 36. The first part of the action is due to the coarse rotational adjustment of the outer sleeve member 36 effected by adjustment ring 41 and the second part of the action is due to the vertical movement of the outer sleeve member 36 effected by rotation of adjustment ring 64. In the first case, the helix angle of the gear causes rotation of the pinion and in the second case the gear on the outer sleeve member acts as a rack.

Rotation of the pinion turns th slider of potentiometer 56. The potentiometer 56 provides an analogue output signal which is processed by circuitry carried on a printed circuit board 67 to provide a signal for operating the digital display 16. In figure 3, reference 66 denotes the battery supply for the display, whilst in Figure 1 reference 67 denotes the printed circuit board carrying processing circuitry.

With reference to Figures 3 to 5, it is to be noted that, for accuracy in dispensing, rotationaly movement of the geared outer sleeve member 36 is maximised, thus also maximising potentiometer adjustment, by arranging the stop fins 40 on the upper part of the outer sleeve member 36 in 30 degrees increments for positions 1 to 6 and likewise for stop positions 7 to 12, with a 15 degrees step between stop positions 6 and 7, thus enabling the positions 7 to 12 to be angularly positioned alternately with positions 1 to 6, as will be clear from the drawing, wherein the positions of the internal indent slots 54 are numbered 1 to 12 in correspondence with the pairs a and b of stop fins 40 which are numbered in the same sequence. Figures 3 and 4 show the detent ball 50 engaged in indent slot number 1, and the fins 1a, 1b aligned with the stops 38. Figure 5 shows the cylindrical shape of the sleeve 36 "unfolded", revealing the relative positions of the stop fins 40, with the longest fins 12a, 12b aligned with the stops 38.

In use, the operator primes the unit by pumping the cap member 30, assuming the unit has been freshly fitted to a storage jar. The cap member 30 is then held down and the electronic display is switched on. With fine adjustment ring 64 screwed out, coarse adjustment ring 41 is then clicked round until the display indicates a slightly higher value than the amount of liquid required to be dispensed. The indicated value is then brought exactly to the required amount by use of the fine adjustment ring 64, which for this purpose is screwed in. The cap member 30 is then pulled up to the maximum stroke permitted in order to draw the required amount of liquid upwardly through the open valve 72, 74 and into the cylinder 20. When d pressed thereafter, the indicated amount of liquid is dispensed, in the manner of a pipette, through the open valve 76 and 78 and the delivery tube 14. After use the electronic display is switched off by switch 18.

Claims

1. A liquid dispenser comprising a unit having means enabling its connection to a reservoir containing a liquid to be dispensed and a discharge tube through which a selected amount of said liquid can be dispensed, the unit including a cylinder and piston combination enabling the selected amount of liquid to be drawn into the cylinder from the reservoir through a check valve means and the said selected amount of liquid to be dispensed through th discharge tube via a second check vale means, wherein a selector means for adjustable stops for setting the cylinder/piston stroke to select the amount of liquid to be dispensed is coupled to an electromechanical transducer which provides an electrical signal for controlling operation of a display means which indicates the amount of liquid selected.

2. A liquid dispenser according to claim 1, wherein the display means is a digital display device incorporated in the unit and electrically driven by a drive signal obtained by processing the output signal of the transducer.

3. A liquid dispenser according to claim 1, wherein the transducer is a potentiometer.

4. A liquid dispenser according to any of the preceding claims, wherein the selector means includes a stop supporting member which is rotatable for setting the cylinder/piston stroke.

5. A liquid dispenser according to claim 4, wherein the stop supporting member carries a helical gear which drives a pinion coupled to the transducer.

6. A liquid dispenser according to claim 4 or 5, wherein the stop supporting member is rotatable in angular steps, defined by detent means, to select any one of a plurality of axially extending stops of differing axial length which limit the cylinder/piston stroke.

7. A liquid dispenser according to claim 6, wherein the rotation of the stop supporting member provides for coarse selection of the amount of liquid to be dispensed, the stop supporting member being adjustable in the axial direction, carrying the axially extending stops with it, for fine adjustment purposes.

8. A liquid dispenser according to claim 7, wherein axial movement of the stop supporting member is enabled by a tapered thrust washer.

9. A liquid dispenser according to any of claims 6 to 8, wherein the detent means which defines the angular positions of the stop supporting member take the form of a spring loaded ball detent cooperating with angularly spaced slots in the stop supporting member.

10. A liquid dispenser according to any of claims 6 to 9, wherein each axially extending stop is formed in two diametrically opposed similar parts.

11. A liquid dispenser according to claim 10, wherein the range of rotational adjustment of the stop supporting member, and thus of the gear

coupling which drives the transducer, is increased by arranging the stops of progressively increasing axial length in two or more interleaved groups.

12. A liquid dispenser according to claim 11, wherein the said angularly extending stops, each comprising two diametrically opposed similar parts, cooperate with a pair of stop elements carried by a piston drive member which is exposed for manual operation.

13. A liquid dispenser according to claim 12, wherein the stop elements are also a diametrically opposed pair.

14. A liquid dispenser according to claim 13, wherein the stop elements are located on a diameter at right angles to the diameter on which the gear coupling is located, so that wear in the gears does not affect the accuracy of selection of the amount of liquid to be dispensed.

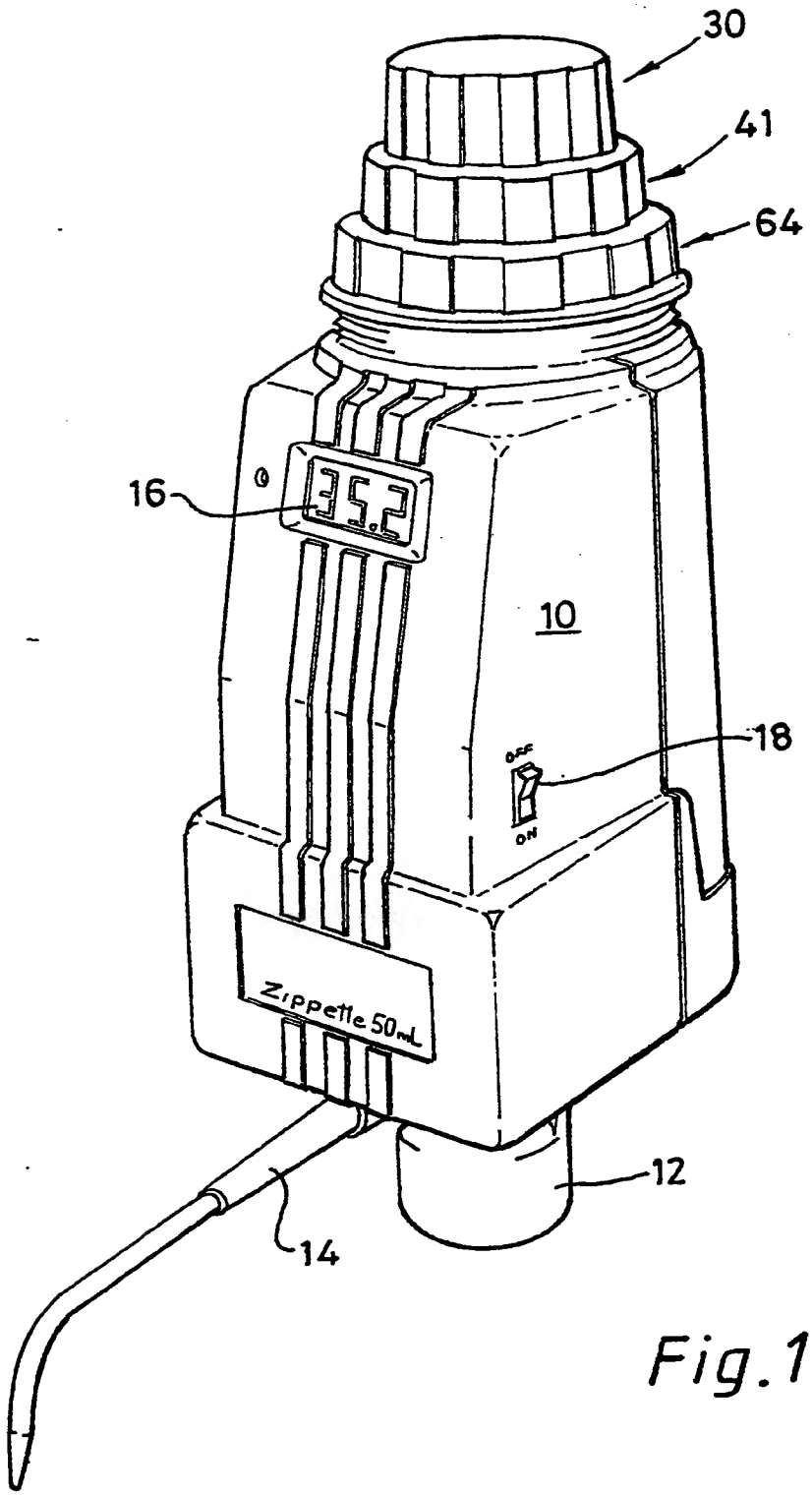

Fig.1

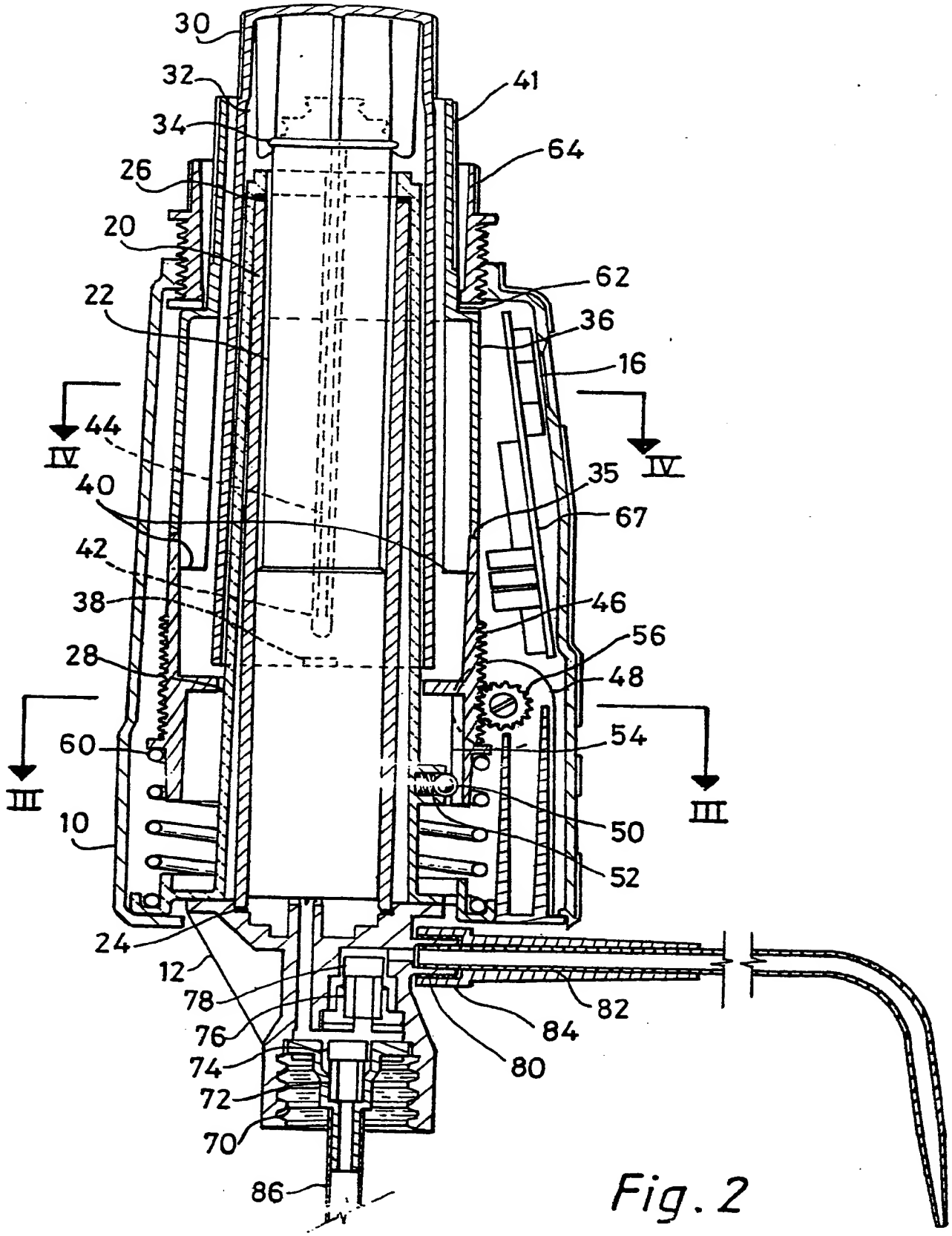
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Fig. 2

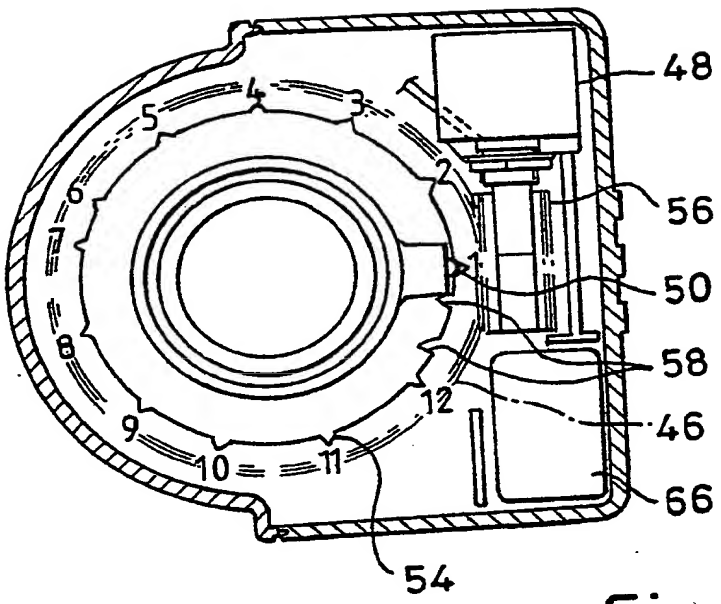
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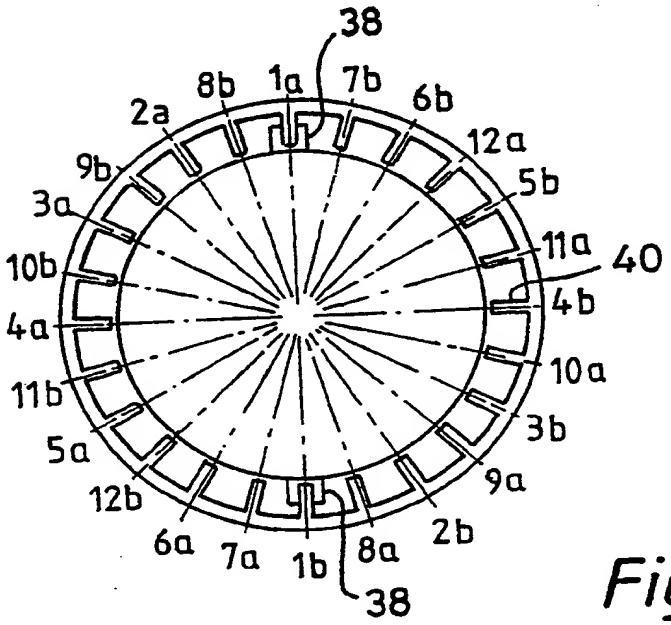
Fig.3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2b
6a
7a
1b
8a
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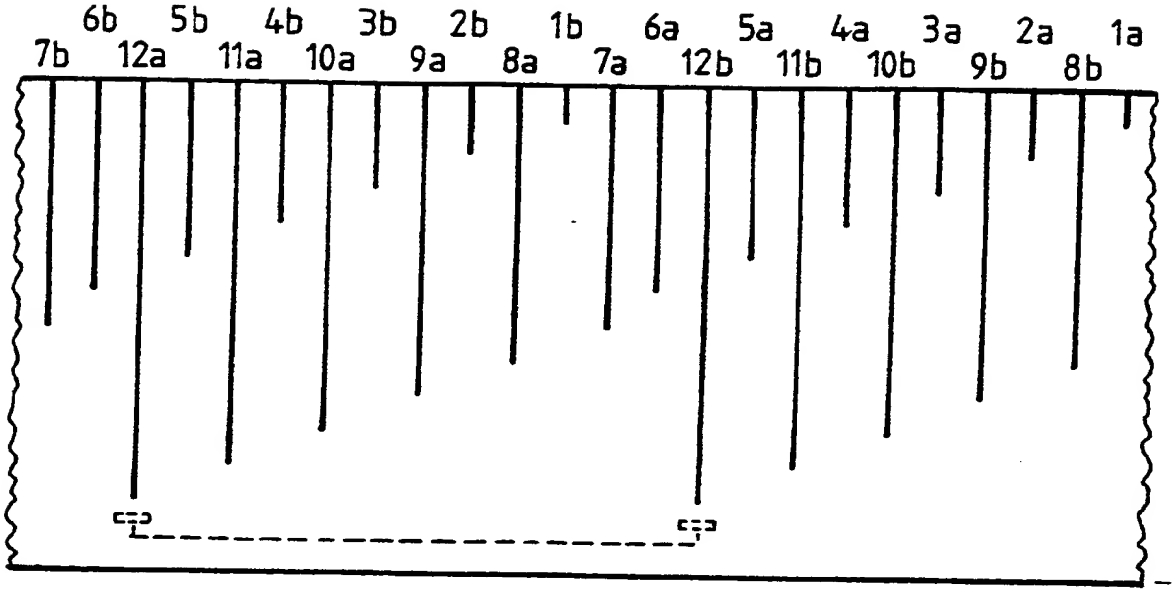
Fig.4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7b 12a 11a 10a 9a 8a 7a 12b 11b 10b 9b 8b

Fig. 5